

Interseeded Cover Crops, Soil Health and Nitrogen Supply for Grain Corn in Ontario

Y. Katanda*, M. Sharifi, D. Hooker, J. Clark, and A. Messiga

* Ph.D. Candidate, Trent University

Presentation Outline

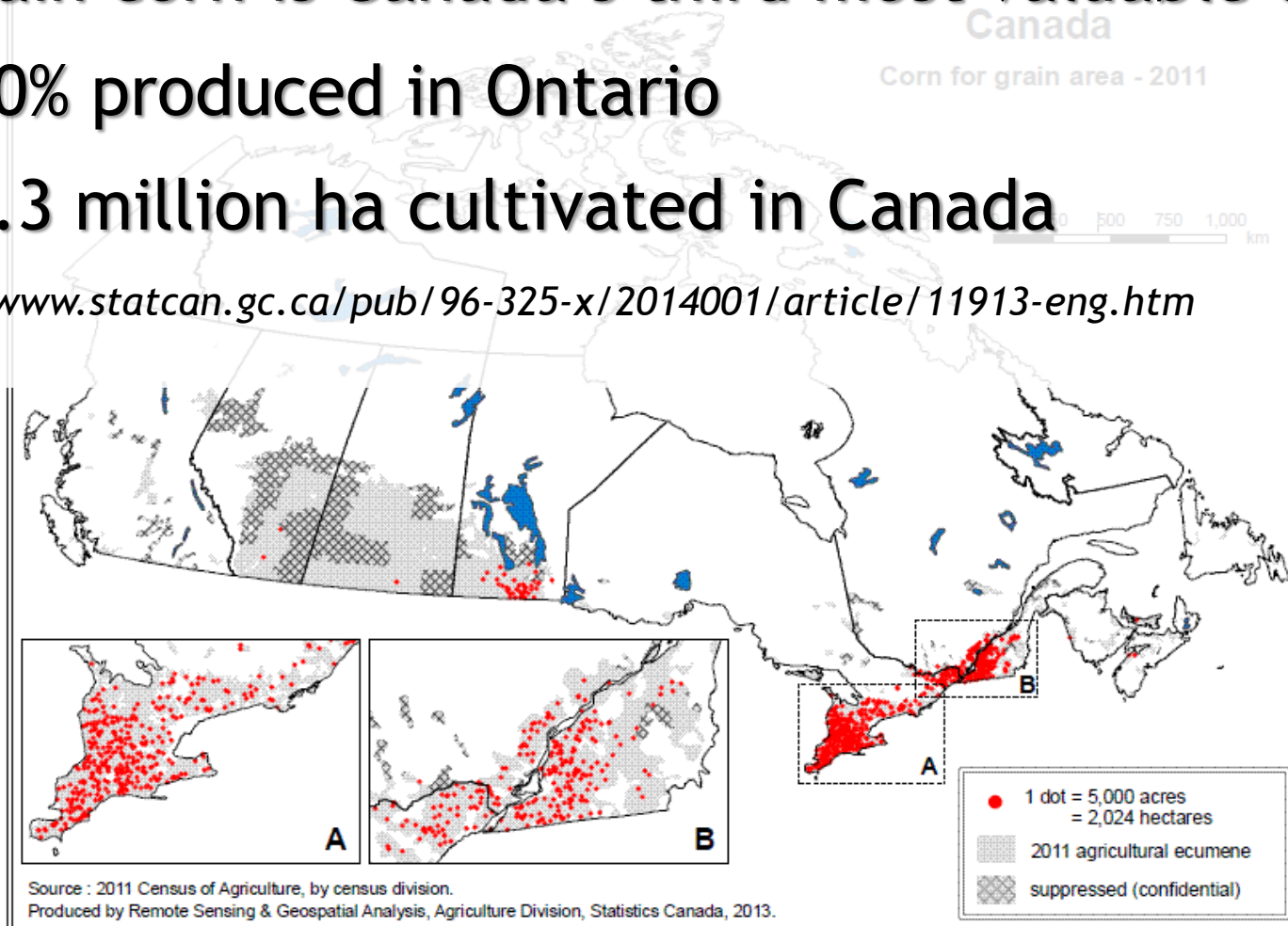
- Introduction
 - Research Problem
 - Objectives
- Methodology
- Results
- Conclusions



Canada's Corn

- Grain corn is Canada's third most valuable crop
- >60% produced in Ontario
- ~1.3 million ha cultivated in Canada

- <http://www.statcan.gc.ca/pub/96-325-x/2014001/article/11913-eng.htm>



Research Problem

Agriculture and Agri-Food Canada:

- 82 per cent of Ontario farmland loses soil organic matter annually
- Shorter rotations (corn-soy) increasingly dominating Ontario's landscape

<http://www.agr.gc.ca>

Cover Crops

- Erosion control
- Weed suppression
- Limit loss of excess nutrients esp. N and P
- Biological N fixation - improved N supply
- Soil organic matter C and N addition
- Improvement of soil health



Interseeding Cover Crops in Corn

- Higher chance of establishment compared to broadcasting
- 5-leaf stage (early Jun)



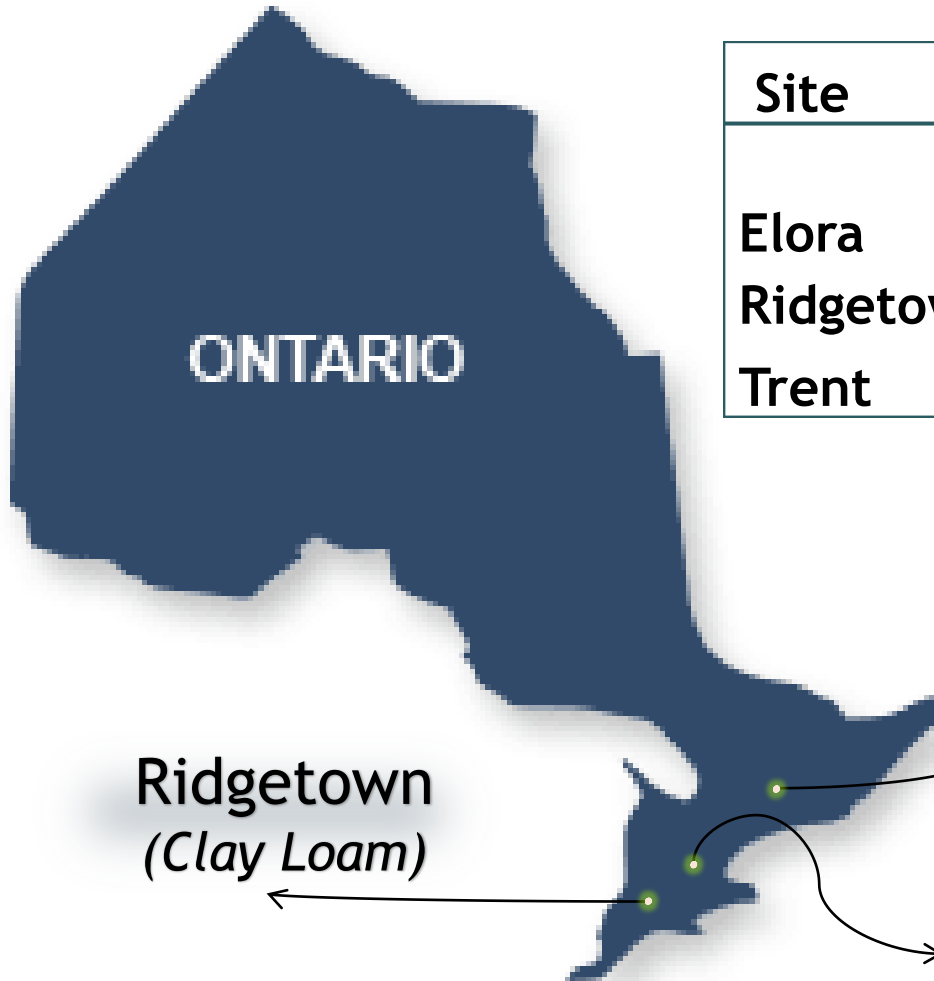
Research Objectives

Evaluate effects of interseeded cover crops on:

1. Corn N uptake and grain N content
2. Soil Health Indicators
 - Particulate organic matter C and N
 - Soil microbial biomass C and N
 - B-Glucosidase and dehydrogenase enzyme activities
 - Microbial community structure



Study Sites



Site	Total C	Total N	CEC	pH
	g kg ⁻¹		meq 100g ⁻¹	
Elora	23.1	2.0	19.1	8.2
Ridgetown	25.9	2.1	19.9	7.2
Trent	31.9	2.1	24.3	7.9

Peterborough
(Trent) (*Sandy Loam*)

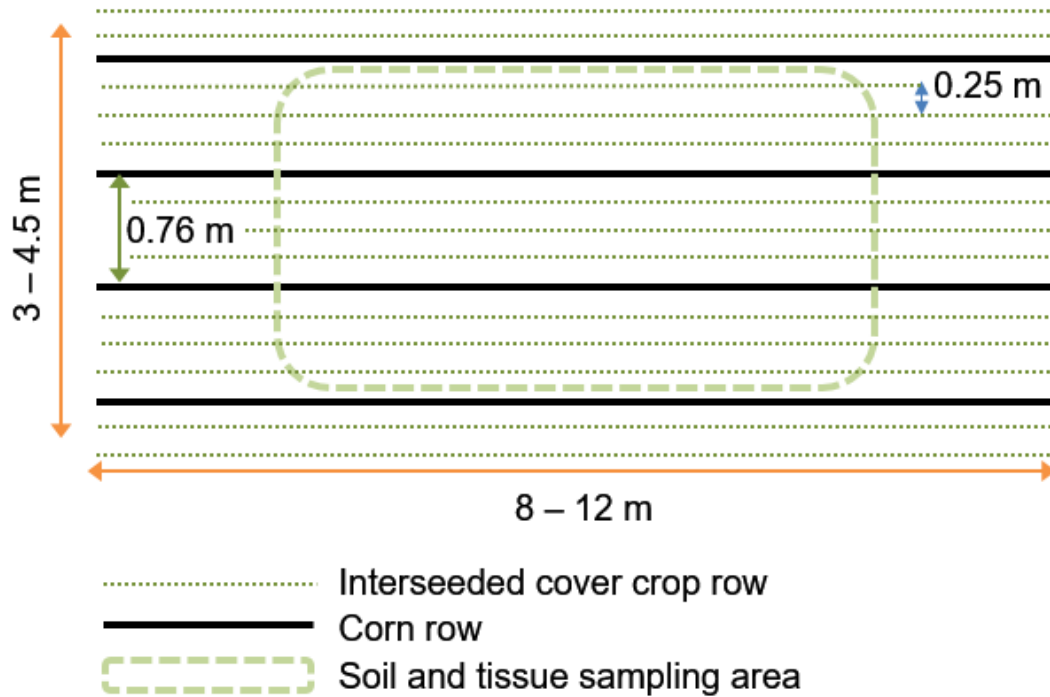
Elora
(*Loam*)

Ridgetown
(*Clay Loam*)

Experimental Design

- RCBD: 4 Blocks
- 4 Site-years x 4 Cover crops
 - Red clover (RCL)
 - Annual ryegrass (ARG)
 - 1: 3.3 RCL/ARG mixture (Mixture)
 - No cover crop (Control)
- ANOVA, Proc GLIMMIX, SAS v9.4
 - $P < 0.05$; Tukey-Kramer mean separation procedure
- Correlation analyses in Origin Pro

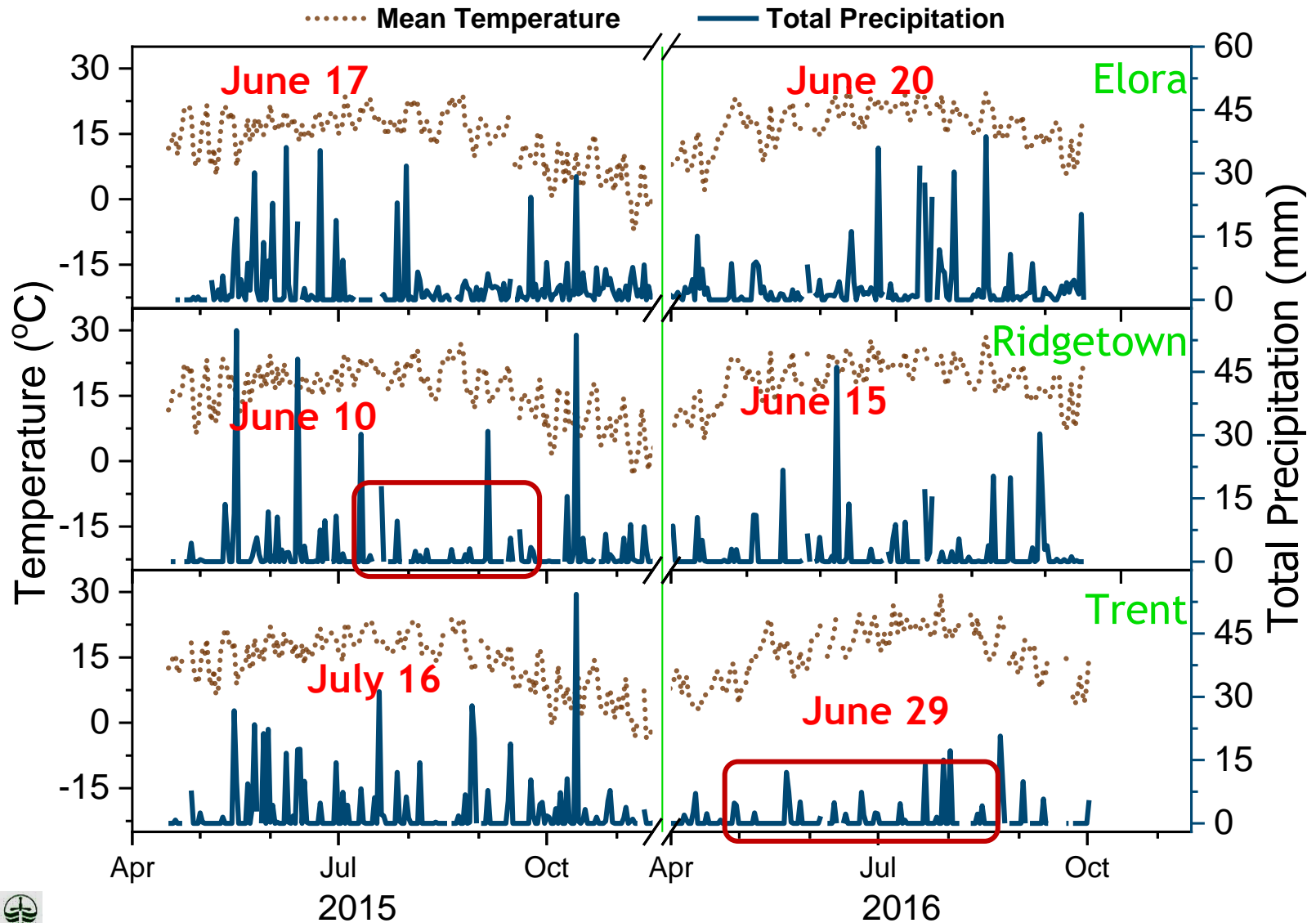
Plot Establishment



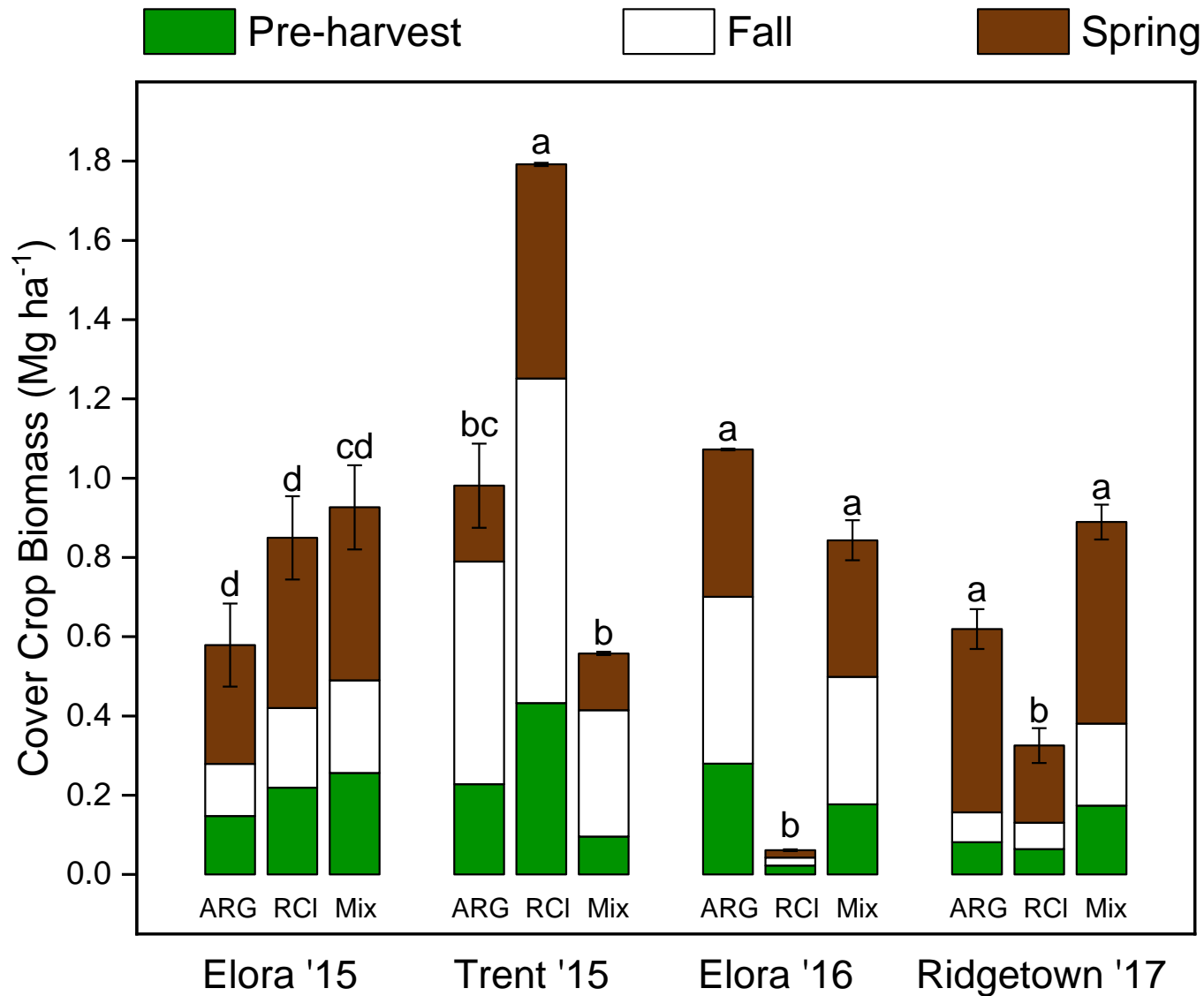
Ridgetown: June 22, 2015

Cover Crop	Seeding Rate (kg ha ⁻¹)
Red clover (RCL)	9
Annual ryegrass (ARG)	27
RCL:ARG Mixture (MIX)	6.7:22.4

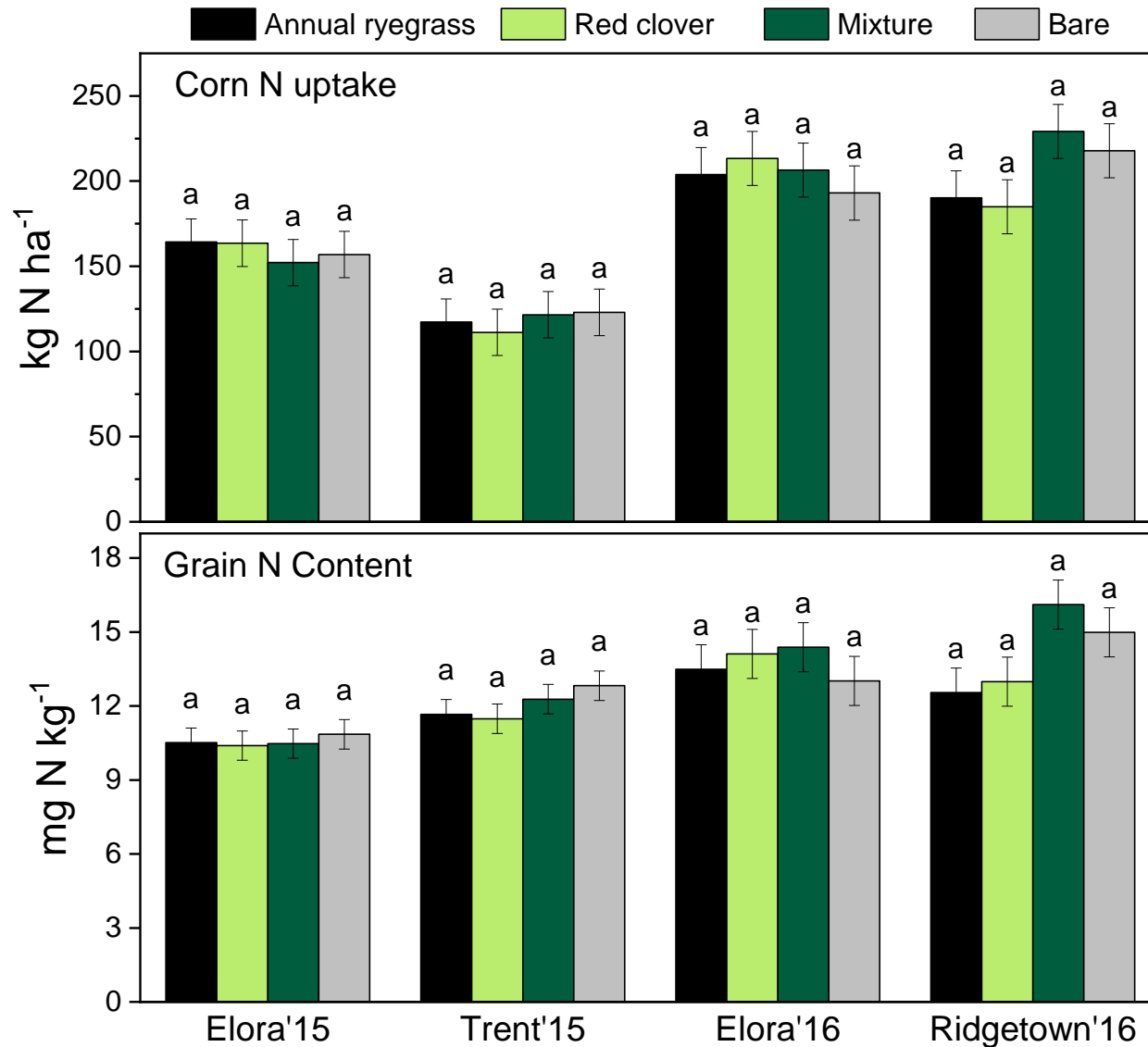
Climate Effects on Establishment



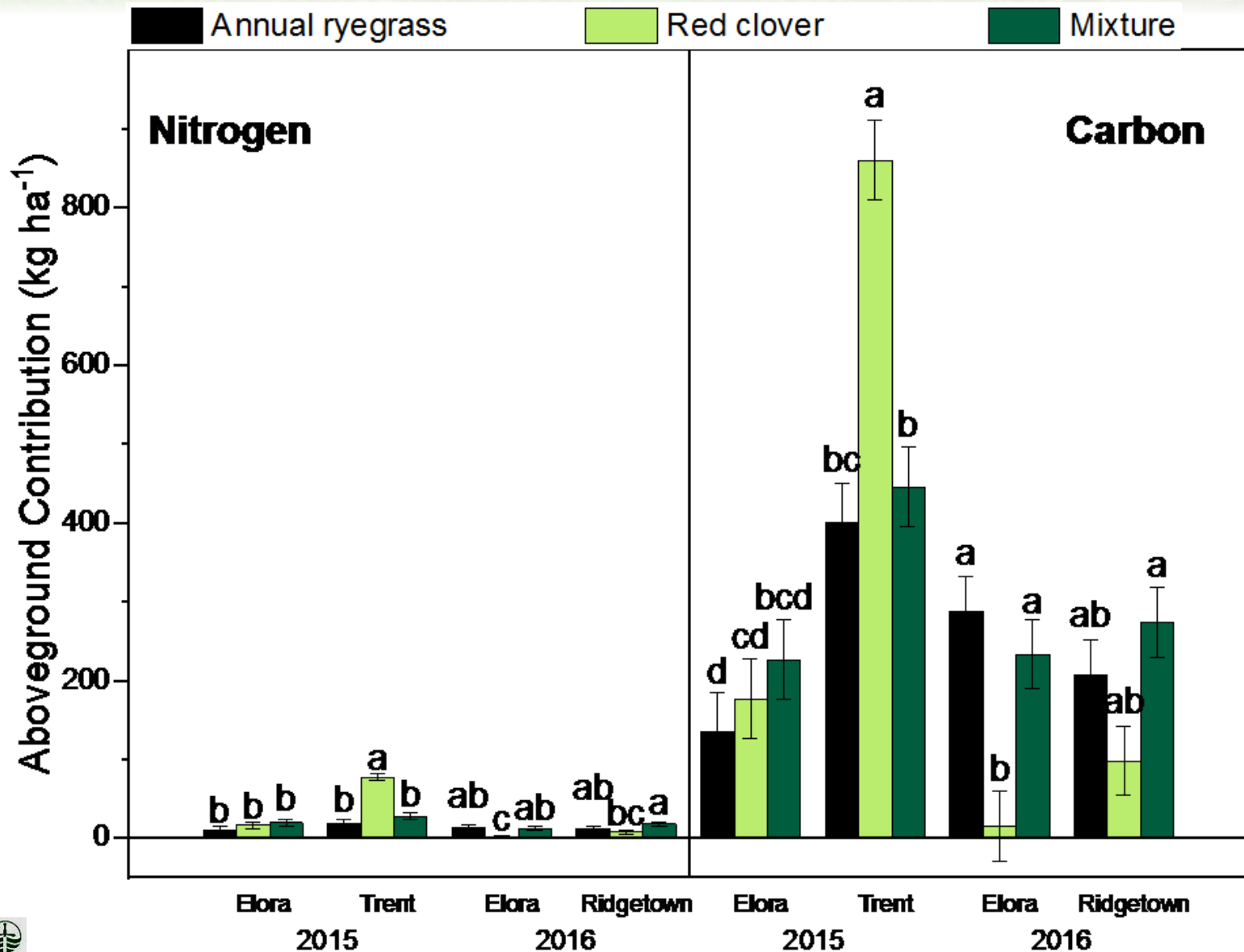
Cover Crop Aboveground Biomass



Cover crops and corn N supply



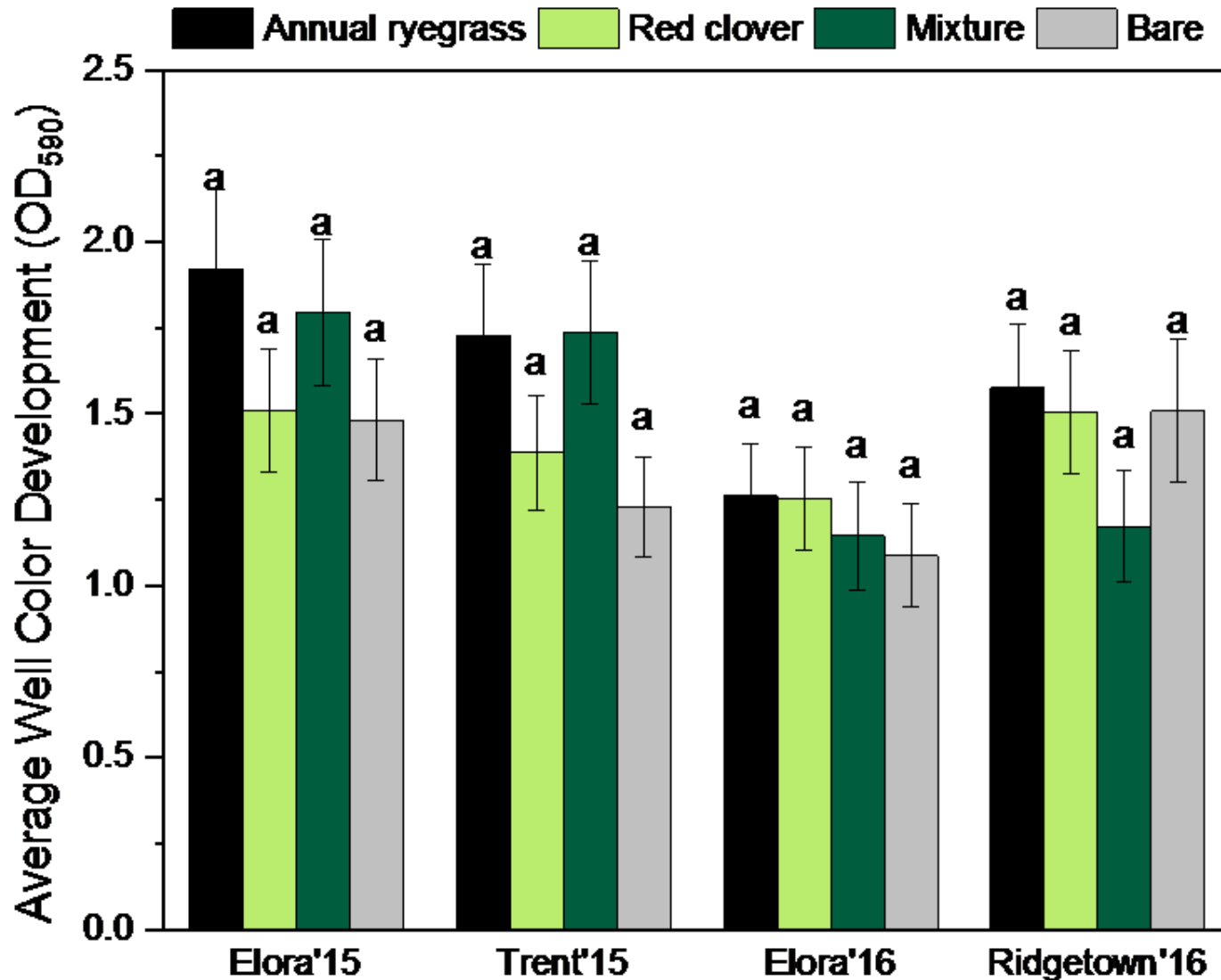
Carbon and Nitrogen from Cover Crops



Cover Crop Biomass and Soil Health Indicators

Indicator	Annual		
	Ryegrass	Mixture	Red Clover
	<i>Pearson Correlation Coefficient (r)</i>		
Soil Microbial Biomass-N	-0.05	0.12	0.34
Soil Microbial Biomass-C	0.66	0.39	0.48
Soil Microbial Biomass-C/N	-0.06	-0.15	-0.22
B-glucosidase Activity	0.54	0.13	0.57
Dehydrogenase Activity	0.23	-0.50	-0.27
Soil Mineral Nitrogen	-0.14	-0.16	-0.45
POM-C	0.54	0.25	0.65
POM-N	-0.25	-0.25	-0.21
POM-C/N Ratio	0.63	0.68	0.89

Microbial Community Diversity



Conclusions

- When successfully established, interseeded annual ryegrass and red clover contributed significant amounts of C and N each season, **without reducing corn N supply**
- Seasonal effects of interseeded annual ryegrass or red clover on most soil health parameters were not detectable
- However, there were significant correlations between cover crop biomass yield and microbial biomass C, β -Glucosidase activity, and POM
- Community-level physiological profiling showed significantly greater microbial diversity with annual ryegrass



THANK YOU!!!



**Dr. T. Hutchinson, Dr. M. Sharifi, Dr. L. Van Eerd, Dr. D. Hooker, Dr. A. Messiga
S. Baker, M. Jones, J. Clark, M. Ruguwa, S. Dasne**